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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/664,781	09/16/2003	Christophe Maleville	4717-6100	4844

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EXAMINER

CARRILLO, BIBI SHARIDAN

ART UNIT	PAPER NUMBER
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1746

DATE MAILED: 11/29/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No.	Applicant(s)	
	10/664,781	MALEVILLE ET AL.	
	Examiner	Art Unit	
	Sharidan Carrillo	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 August 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-5, 11-15, 17-24 and 26-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-5, 11-15, 17-24, and 26-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 2-5, 11-15, and 26-31 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for an ozone atmosphere, does not reasonably provide enablement for any type of gaseous atmosphere. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims.

The claims embrace an invention which contains any known gaseous atmosphere, which could/can be selected from literally thousands (i.e. IPA, nitrogen, argon, oxygen, water vapor). It does not appear to be feasible that any gaseous atmosphere would function in the present invention. Further, for one skilled in the art to reproduce the present invention (which must be possible, if the specification is adequate), there would clearly be undue experimentation to do so in an attempt to figure out which gaseous atmospheres work and which ones do not.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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4. Claims 2-5, 11-15, 17-24, 26-35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 29 is indefinite because it is unclear whether "a substrate surface" refers to the bondable surface on the substrate or the other substrate. Additionally it is unclear whether "treating the substrate" refers to first substrate recited in the preamble or the "another substrate". Similarly, it is unclear whether "saturating and removing the substrate" refers to the first substrate having the bondable surface or another substrate. The examiner suggests amending the claims to the first and second substrates respectively. Claims 2-5, 17-19 are indefinite because "wet chemical etching" lacks positive antecedent basis since claim 29 recites a wet chemical etching process. Claims 3 and 17 are indefinite because it is unclear how water etches the surface. It is unclear whether applicant intends an aqueous solution of ammonium fluoride. Claim 13 is indefinite because the term wafer lacks positive antecedent basis. Additionally "the etched surface" lacks positive antecedent basis. Additionally, it is unclear whether "one substrate" refers to the first substrate recited in the preamble. One again, the examiner suggests amending the claims to include a first and second substrate. Claim 20 is indefinite because "the same wet chemical etching process" lacks positive antecedent basis. Claim 20 is indefinite because "the etched surfaces" lack positive antecedent basis. Claim 27 is indefinite because it is unclear whether applicant is referring to the bondable surface of the substrate or another substrate. The examiner suggests first and second substrates respectively. Claim 28 is indefinite because it is

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unclear what is meant by "enhanced bonding". Claim 31 should recite "the dry hydrophilic surface" instead of "a dry hydrophilic surface". Claim 32 is indefinite because it is unclear whether "saturating the surface" refers to the first substrate. Claim 34 is indefinite because the preamble should recite a first substrate.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 2-5, 11-12, 26, and 29-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schellenberger et al. (5714203) in view of Bergman et al. (6286231) in view of Wu et al. (US2003/0087532) and further in view of Muraoka (US2003/0138552).

Re claims 11 and 29, Schellenberger teaches providing a bath 2 containing an etchant 3, providing a substrate (i.e. semiconductor), treating the wafer by etching in a bath, saturating the wafer with hydrogen (Fig. 3a), as a result of etching with HF, removing the substrate from the bath (Fig. 2) by exposing the wafer to a gaseous atmosphere (O₂/O₃) to form a dry hydrophilic surface.

Schellenberger fails to teach positioning the bath in a closed container. Bergman teaches a method and apparatus for drying semiconductors inside a closed container. In the embodiment of Fig. 8A, the bath 402 is positioned inside a closed container having a gaseous atmosphere via 408 in order to collect any excess overflow of liquid into the surrounding basin. Additionally, the skilled artisan would have recognized the advantages of inserting a bath into a closed container for purposes of further reducing the amount of contamination present on the wafer surface. It would have been obvious to modify the method of Schellenberger to include inserting a bath into a closed vessel, as taught by Bergman, for purposes of eliminating the need for an overflow basin and to prevent contamination on the wafer surface in addition to applying the gaseous atmosphere within a confined area.

Schellenberger fails to teach the wafer having an oxide layer. It is well known, as evidenced by Wu, that oxide layers formed during the manufacturing of semiconductor wafers, are removed by etching with conventional etchants such as HF. Given the teachings of Wu, one would have reasonably expected the semiconductor wafer of Schellenberger to include oxide layers to be present on the wafer surface, since oxide layers are formed during the manufacturing of semiconductor devices, and further expected the oxide layers to be readily etched by the etchant bath of Schellenberger.

Schellenberger teaches forming a hydrophilic surface by reaction with O₂/O₃. Schellenberger fails to teach the formation of silanol sites. Muraoka teaches that hydrophilic surfaces generated on the substrate surface terminates with Si-OH (silanol sites). One would have reasonably expected the hydrophilic sites of Schellenberger to include silanol sites since Muraoka teaches that hydrophilic silicon surfaces on wafers terminates in OH groups.

Re claims 2-3, refer to the abstract of Schellenberger. Re claim 4, refer to paragraph 57 of Wu. Re claim 5, refer to col. 4, lines 30-35 of Schellenberger. Re claim 12, refer to the abstract of Schellenberger. Re claim 26, one would have reasonably expected the oxygen/ozone to saturate the surface since the substrate is withdrawn from the liquid while being exposed to O₂/O₃ and further since Schellenberger is performing the same steps as the instantly claimed invention. Re claims 30-31, refer to the teachings of Schellenberger and specifically col. 3, lines 15-17 and claim 22 of Schellenberger.

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9. Claims 13-15, 17-24, 27-28, and 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schellenberger et al. (5714203) in view of Bergman et al. (6286231) in view of Wu et al. (US2003/0087532) and further in view of Muraoka (US2003/0138552), as applied to claims 2-5, 11-12, 26, and 29-31, as described in paragraph 6 above, and further in view of Geusic (6630713).

In reference to claims 13-15, 22, and 32, Schellenberger et al. fail to teach bonding the etched surface and annealing at a temperature of 500 degrees centigrade. Geusic teaches a method of bonding one semiconductor surface to a second semiconductor surface. In col. 4, lines 20-30, Geusic teaches it is convention to anneal surfaces at a temperature of at least about 500 degrees centigrade. In col. 5, lines 20-60, Geusic teaches etching the wafer surface with HF solution and further teaches bonding the wafer prior to annealing in order to retain cleanliness of wafer surfaces. It would have been obvious to a person of ordinary skill in the art to have modified the method of Schellenberger et al. to include bonding and annealing since such steps, as taught by Geusic are conventional in the semiconductor manufacturing process. Additionally, applicant's own specification (page 6) teaches that the limitations of laying one wafer on top of another and applying pressure are conventional steps used in wafer bonding. In reference to bond strength and claim 21, one of ordinary skill in the art would reasonably expect the annealing to increase the bond strength to between 0.28 to 0.38 since Geusic is performing annealing at the same temperature as that of the instantly claimed invention. In reference to claim 17, refer to the abstract of Schellenberger. In reference to claim 18, refer to the abstract of Schellenberger. Re

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claim 19, refer to col. 4, lines 3-35 of Schellenberger. In reference to claim 20, it would have been obvious to a skilled artisan to treat another substrate by wet etchings in order to remove contaminants from the substrate surface prior to bonding. In reference to claims 23-24, refer to the teachings of Schellenberger. In reference to claims 27-28 and bonding the surface to another surface containing silanol sites, Geusic et al. teach bonding of the wafers together by Si-Si bonds (col. 7, lines 30-35). Re claims 33-34, Geusic teaches bonding the substrates together after the surfaces are etched with HF to produce a hydrophobic surface. Geusic further teaches that the wafers are bonded together, prior to annealing in order to retain cleanliness. In col. 5, lines 65-68 teaches removing the hydrogen from the wafer prior to annealing. Additionally, col. 7, lines 20-35 teaches removing the hydrogen from the wafers, annealing the surfaces and pressing the surfaces of the two wafers together to form Si-Si bonds. Therefore, one would reasonably expect the surface to be hydrophilic since Geusic teaches a) bonding prior to annealing in order to maintain the cleanliness and b) removing the hydrogen from the wafer prior to annealing. In reference to claim 35, refer to col. 7, lines 30-35 of Geusic.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hung et al. teach a wet processing apparatus. Bergman et al. teach an apparatus for drying the wafers. Brunner teaches chemical treatment of wafers. Bansal et al. teach producing a hydrophobic silicon wafer.

Response to Arguments

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10. The rejection of the claims under 112, second paragraph is maintained for the reasons set forth above.

11. The rejections of the claims, as being anticipated and unpatentable over Hishiya et al. are withdrawn in view of view of the newly amended claims.

12. The rejections of the claims, as being unpatentable over Wu in view of the secondary references are withdrawn in view of the newly amended claims.

13. Applicant argues that Geusic does not suggest forming a dry hydrophilic surface with silanol sites. Applicant is directed to col. 7, lines 20-35 which teaches the removal of hydrogen from the wafer surface, thereby removing the hydrophobic nature, annealing the wafers and bonding the wafers together to form Si-Si bonds.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sharidan Carrillo whose telephone number is 571-272-1297. The examiner can normally be reached on M-W 6:30-4:00pm, alternating Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on 571-272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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Art Unit 1746

